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It is held that the essence of education is found primarily in the processes of acquiring and using knowledge, and secondarily in the command of bodies of information and ideas. The four "process goals" which apply to any discipline are: tool skills such as arithmetic and reading; problem-solving, thinking, or inquiry; self-instruction; and self-evaluation using the criterion of mastery. These processes are not necessarily distinct and should be present in most educational tasks. Unfortunately, not one of these goals is being achieved satisfactorily by the majority of students in elementary school, high school, or college. This is cited as the main reason for the increased popularity of teaching machines in which students are not required to go through a thinking process but are provided with all of the basic information at their fingertips. Teachers are blamed for the failures of their students to attain these basic goals because such goals are no longer being emphasized adequately. Questions are raised relative to the desirability or the possibility of including these process goals in the programing methods of programmed instruction. It is pointed out that the most vital part of a program to restore to American education the learning of these "process goals is first to educate the teachers to their importance in the educational process and encourage their inclusion in curricula."

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FOUR PROCESS GOALS OF EDUCATION

From

Notes on the Strategy of Educational Reform

by

Glen Heathers

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FOUR PROCESS GOALS OF EDUCATION

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The essence of education is found primarily in the processes of acquiring and using knowledge, secondarily in the command of bodies of information and ideas. Classic statements of the educative process are to be found in the writings of John Dewey, especially in How We Think and Experience and Education. In the latter volume, Dewey asserted that the heart of education lies in mastering the scientific process of inquiry. Jerome Bruner's The Process of Education is an important recent statement on the subject.

What is the process of education? It will serve present purposes to describe it in terms of four "process goals" that apply to acquiring and using knowledge in any discipline: tool skills; problem-solving thinking, or inquiry; self-instruction; and self-evaluation using a criterion of mastery. These are called learning goals (ends) rather than methods (means) since students learn them, and practice their use, as a central part of becoming educated.

Naming four process goals does not mean that there are four processes of education, one corresponding to each goal. Instead, the goals relate to aspects of the process of education, and many times all four aspects are present in the same learning activity. Thus, a child may set out to solve a mathematical puzzle--self-instruction; in solving it, he must use problem-solving thinking; he reads the puzzle, and uses arithmetic in working out a solution--tool skills; and he doesn't stop until he knows he has the correct solution--mastery.

Defining the process goals

Tool skills include the whole array of communication skills used in reading, listening, writing, and speaking. They include skills in computation. They include the techniques of observing, manipulating, and measuring things. It should be noted that the classical Three R's are tool-skill subjects.

Problem-solving thinking or inquiry is generally considered to be the core of the educational process, and the chief mark of the educated person. It is the route to understanding, and the basis for invention, planning, interpretation, and criticism. In formal education, problem-solving thinking is not focused on learning to deal with practical problems of everyday living. Instead, it deals mainly with intellectual problems within the academic setting of a discipline. Yet these problems must still be real in the sense of being testable.

Self-instruction, or self-direction is acquiring and using knowledge, is the essential partner of problem-solving thinking. A teacher cannot do the thinking for his students. The student himself must learn to identify and analyze problems, gather relevant information, develop and test plausible solutions, and evaluate outcomes. Motivation to learn for the joy of learning is a prime requisite for self-instruction.

Teaching the student to evaluate his work by employing criteria of mastery may seem not to belong in a list of the process goals of education. But anything that is only partially learned is of little use either in dealing with practical matters, or as a stepping stone to further learning. Frustration, a sense of failure, and feelings of inadequacy accompany shoddy learning. Pride in accomplishment is essential if the student is to learn to love learning, and to devote his energies to improving his mind. The individual's contributions to society depend greatly on how well he masters the knowledge and skills called for in his roles as worker and citizen. Further, mastery and national morale are

intimately related, as John Gardner has indicated in Excellence. "Getting by," "goofing off," and "beating the game" would not be so prevalent if future workers learned the habits and pleasures of mastery in our schools.

Neglect of the process goals

Today, not one of the four process goals is being achieved satisfactorily with the majority of students in elementary school, high school, or college. In the case of tool skills, we note that deficiencies in reading are perennially a matter of national concern. Deficiencies in written composition are so great that many colleges must give remedial courses in Englis composition. Many high school and college students cannot perform the fundamental operations of simple arithmetic with accuracy and speed. Skills in observation and measurement are either ignored or poorly taught. It is noteworthy that the term "research" as used in the elementary school ordinarily means looking things up in books, magazines, or newspapers. Most teachers are poorly trained even to teach skills. Thus, in one large school system, Ackerlund found that over sixty per cent of elementary teachers felt that they were not equipped to teach reading effectively.

Problem-solving thinking is poorly taught in all curricular areas from first grade through college. The majority of students never learn the methods of inquiry in any discipline. Much of the fault lies in curricular materials. In most schools, the teaching of mathematics through the eighth grade is largely confined to the tool skills of arithmetic. The science curricula in the elementary and junior high schools have stressed facts and technological applications rather than scientific theory and methods of inquiry. The social sciences have mainly been taught with an emphasis on fact and description, rather than explanation. The curricula in art and music have focused on skills and free expression and have not given proper attention to the analysis of how esthetic effects are achieved.

Self-instruction is slighted even more than problem-solving thinking in our schools. For the great bulk of the time at school, and with the great majority of students, learning occurs with curricular materials and teaching methods that permit a minimum of self-instruction. One shocking result is that, in many graduate departments, the master's thesis is no longer required because candidates for the master's degree cannot plan and conduct worthwhile studies. Probably it is the common lack of effective study skills, more than any other reason, that is giving rise to programmed instruction. Students who do not know how to study can succeed with teaching machine programs that present all the information and learning cues needed, are organized into tiny steps, and provide immediate knowledge of results.

The failure of our schools to teach self-instruction is not just a failure to teach methods of independent study. Equally, it is a failure to instil the love of learning. Most students behave as students only while at school, and only to meet school requirements. Voluntary learning, even among college graduates, occurs most often in relation to hobbies. The self-educating adult is so uncommon that, when identified, he receives special notice.

Self-evaluation employing a criterion of mastery is ignored in American education to a degree that shocks visitors from other countries. Most students never learn anything well. In every classroom, the teacher must cope with students whose previous learning does not equip them to tackle the work at hand.

Abetted by psychologists and test makers, we ignore mastery and "grade on the curve." And the curve we use is the normal, bell-shaped distribution curve. A few students receive excellent marks, most receive intermediate marks, and a few receive poor or failing marks. Out of misplaced kindness, teachers distort the distribution of grades upward, even further abandoning the mastery criterion.

There is another curve that might serve as a model. This is the "J-curve"

that represents conformity to standard, such as coming to a halt at a stop sign. If this curve applied to education, the great majority of students would get high marks showing accomplishment of requirements. If we are to require excellence from all students, we must see that the student is taught the material he is ready to learn, that he is taught it in a way and at a pace that enable him to master it, and that he is not permitted to proceed further in the subject until he has mastered the material at hand. The distribution of "grades" for this sort of instruction would be a J-curve.

The mastery criterion does not ordinarily require complete and final knowledge of a topic. There are levels of understanding or skill with reference to any topic. The sort of mastery required of the student should be appropriate to his advancement in the curricular sequence, and to his abilities. It is here that the bell-shaped distribution curve still applies. There will continue to be a normal distribution of differences in time required to learn to a given criterion of mastery, in the complexity of material that students can master, and in students' abilities to apply knowledge in new situations.

Present reform strategy and the process goals

Many of the projects in today's reform movement were planned, at least in part, to stress aspects of the process of education and progress toward achieving the process goals may be expected. Teaching thinking is a major purpose of the new curricular materials in mathematics, science, and social studies. Research on the inquiry process already is offering help in reshaping the curriculum in these disciplines. Self-instruction is receiving emphasis in some of the new materials in science. The language labo ratory provides an effective means of self-paced learning of communication skills.

The Durrell pupil team learning plan, employing Winnetka-type learning units,

ability can achieve a high criterion of mastery in learning tool skills in spelling and arithmetic. The year's work in a subject is divided into a considerable number of units. For each unit, there are syllabus materials and a subtest to measure achievement. A learning team is composed of two or three students who are ready to work on a given unit. They study together and, when they judge themselves ready, ask the teacher for the qualifying test on the unit. All students, regardless of ability level, are held to the criterion of 90 or better on the test; they cannot advance to the next unit in the sequence until they have achieved this criterion. It is clear that self-instruction, as well as mastery, is emphasized in this plan.

Programmed instruction can contribute greatly to the teaching of tool skills in English, foreign languages, mathematics, and other subjects. Also programmed instruction is dramatically emphasizing the criterion of mastery. Progress through the program demands mastering each successive unit, especially when a machine is used that will not advance the learning materials from one unit to the next until the correct answer has been made.

Programmed instruction is still in the experimental stage, and there are some important questions about its relation to the process goals that have not been answered satisfactorily thus far. One has to do with the extent to which problem-solving thinking can be taught, or practiced, with learning programs. It seems clear that programs can present models and instances of problem-solving thinking. But can they be constructed so that there are different approaches to the solution of a problem, so that the student thinks up the approach he uses rather than selecting one of several alternatives offered to him, and so that more than one right answer is acceptable? What will be the transfer of problem-solving skills developed through programs to learning situations that are not programmed?

Another question is the extent to which learning programs can permit, or foster, self-instruction. Using programs as crutches to support the learning of students who haven't learned how to study is a dubious practice. Perhaps programs can be used in teaching students how to study. In this case, it would seem proper to employ programs mainly in the elementary school, and to dispense with them when the student no longer required the special help they offered.

These questions have been raised since the answers to them will be very important in determining the place that programmed instruction should have in education. It would indeed be unfortunate if widespread use of learning programs worked against accomplishing any of the vital process goals of education. These matters deserve the careful attention of those who are concerned about the strategy of educational change.

Several educational plans that are now being tested probably will strengthen the teaching of process goals, even though they were not designed primarily for this purpose. The ungraded school, the dual progress plan, and the teaching teams plan all encourage the application of the mastery criterion, and lend themsleves to teaching problem-solving thinking through utilizing teachers' special competencies in particular curricular areas. Educational television offers an efficient medium for teaching certain tool skills, and for stimulating problem-solving thinking through exposing students to models that they may emulate.

Assigning first priority to the process goals

These new developments are no more than first steps toward assigning the process goals a central place in American education. They are not adequate to accomplish a transition from content-centered to process-centered education. If problem-solving thinking actually is at the heart of education, the strategy of reform should provide for a great concentration of effort on teaching students

toward teaching all students to teach themselves. Presently, many of the new programs to improve instruction mainly provide opportunities, and create demands, for teaching thinking and self-instruction, rather than making sure that they are taught.

Ways of strengthening education in relation to the process goals are suggested in the next three sections of this article (on achievement tests, individualizing instruction, and teacher education), and in the section on the strategy of timing in the educational campaign. Teacher education is probably most vital. It would indeed be a revolution in instruction if the teacher accepted as his first and most essential task ensuring that his students knew how to learn the subject by employing the methods of inquiry and self-instruction.